LISTING OF CLAIMS

Claims 1-8. (Cancelled)

Claim 9. (Previously presented) A method of cancelling a far end echo from a near end signal, comprising:

estimating an energy level of the far end echo;

cancelling the echo from the near end signal, if the estimated energy level of the far end echo is above an audible level;

bypassing the cancelling, if the estimated energy level of the far end echo is below the audible level; and

controlling convergence of an adaptive filter responsive to the estimated energy level of the far end echo,

wherein estimating the energy level of the far end echo comprises estimating a power level of the far end signal, estimating an echo return loss between the far end signal and the near end signal, and estimating a power level for noise on the near end signal without the echo, and wherein the echo is canceled from the near end signal when the power level of the far end signal minus the echo return loss is greater than both a threshold of hearing and the power level for the noise minus an amount in the range of 8-12dB.

Claim 10. (Cancelled)

Claim 11. (Previously presented) The method of claim 9, wherein estimating the energy level of the far end echo comprises estimating a power level of the far end signal, and estimating an echo return loss between the far end signal and the near end signal, and wherein the echo is cancelled from the near end signal if the estimated power level of the far end signal minus the echo return loss is greater than a threshold.

Claim 12. (Previously presented) The method of claim 9, wherein estimating the energy level of the far end echo comprises estimating a power level of the far end signal, estimating an echo return loss between the far end signal and the near end

signal, and estimating a power level of the near end signal, wherein the selection of whether to cancel the echo from the near end signal is based on the estimated power levels and the estimated echo return loss.

Claim 13. (Previously presented) The method of claim 9, wherein the echo cancellation comprises adaptively filtering the far end signal and subtracting the filtered far end signal from the near end signal.

Claim 14. (Cancelled)

Claim 15. (Previously presented) The method of claim 13, wherein estimating the energy level of the far end echo comprises estimating an echo return loss between the far end signal and the near end signal, and estimating an echo return loss enhancement between the near end signal and the near end signal without the echo, and wherein filter adaptation is a function of at least one of the echo return loss and echo return loss enhancement.

Claim 16. (Previously presented) The method of claim 15, wherein the filter adaptation comprises using an adaptation step size of one-fourth when the echo return loss enhancement is in the range of 0-9 dBm.

Claim 17. (Previously presented) The method of claim 15, wherein the filter adaptation comprises using an adaptation step size of 1/32 when a combination of the estimated echo return loss and the echo return loss enhancement is greater than 33-36 dB.

Claim 18. (Previously presented) The method of claim 15, wherein the filter adaptation comprises using an adaptation step size of 1/16 when a combination of the estimated echo return loss and the echo return loss enhancement is in the range of 23-33 dB.

Claim 19. (Previously presented) The method of claim 13, comprising detecting information in the near end signal, wherein the filter adaptation comprises

limiting the filter adaptation when the information is detected and the filter adaptation is converged.

Claim 20. (Previously presented) The method of claim 13, wherein the filter adaptation is limited when the filter adaptation has been active for a period longer than one second from an off hook transition of a telephony device connected between the far end signal and the near end signal.

Claim 21. (Previously presented) The method of claim 13, wherein the filter adaptation is limited when the filter adaptation has been active for a period longer than one second after filter adaptation initialization.

Claim 22. (Previously presented) The method of claim 19, wherein the filter adaptation comprises using an adaptation step size of 1/32 when the information is detected and the filter adaptation is not converged.

Claim 23. (Previously presented) The method of claim 13, wherein estimating the energy level of the far end echo comprises estimating a power level of the far end signal, and estimating a power level for noise on the near end signal without the echo, and wherein the filter adaptation comprises using an adaptation step size of 1/4 when the estimated power level of the far end signal exceeds the estimated power level of the noise by at least 24 dB.

Claim 24. (Previously presented) The method of claim 13, wherein estimating the energy level of the far end echo comprises estimating a power level of the far end signal, and estimating a power level for noise on the near end signal without the echo, and wherein the filter adaptation comprises using an adaptation step size of 1/8 when the estimated power level of the far end signal exceeds the estimated power level of the noise by at least 18 dB.

Claim 25. (Previously presented) The method of claim 13, wherein estimating the energy level of the far end echo comprises estimating a power level of the far end signal, and estimating a power level for noise on the near end signal without the echo,

and wherein the filter adaptation comprises using an adaptation step size of 1/16 when the estimated power level of the far end signal exceeds the estimated power level of the noise by at least 9 dB.

Claim 26. (Previously presented) The method of claim 9, comprising detecting information in the far end signal, detecting information in the near end signal, and processing the near end signal when information is detected in the far end signal and not in the near end signal.

Claim 27. (Previously presented) The method of claim 9, wherein estimating the energy level of the far end echo comprises estimating a power level of the far end signal, estimating a power level of the near end signal, estimating a power level of a near end signal without the echo, estimating a power level of noise on the far end signal, and selectively non linear processing the near end signal, the selection as to whether to non linear process the near end signal being based on the estimated power levels.

Claim 28. (Previously presented) The method of claim 27, comprising setting a first decision variable as a function of the estimated power level of the far end signal, setting a second decision variable as a function of the power level of the near end signal without the echo, setting a third decision variable as a function of the estimated power level of the far end signal and the near end signal without the echo, wherein the near end signal is non linear processed when at least one of the three decision variables meet a respective criteria.

Claim 29. (Previously presented) The method of claim 28, wherein the first decision variable is set when the estimated power level of the far end signal is at least 6 dB greater than the estimated power level of the noise on the far end signal, and the estimated power level of the far end signal minus an estimated echo return loss between the far end signal and the near end signal is at least 6 dB greater than the estimated power level of the near end signal.

Claim 30. (Previously presented) The method of claim 28, wherein the second decision variable is set when the estimated power level of the near end signal without the echo is at least 9 dB less than the estimated power level of the near end signal.

Claim 31. (Previously presented) The method of claim 28, wherein the third decision variable is set when the estimated power level of the far end signal minus the estimated power level of the near end signal without the echo is greater than a threshold power level.

Claim 32. (Previously Presented) A signal conditioner for conditioning a composite signal, the composite signal being formed by introducing at least a portion of a first signal into a second signal, comprising:

a first signal characteristic estimator for estimating a signal characteristic of the first signal;

a second signal characteristic estimator for estimating a signal characteristic of the composite signal;

a canceller to recover the second signal from the composite signal, if the estimated signal characteristic of the first signal and of the composite signal are above a predetermined level, wherein the canceller comprises an adaptive filter to filter the first signal, and a combined operator to subtract the filtered first signal from the composite signal to recover the second signal;

a bypass to selectively enable the canceller, if the estimated signal characteristic of the first signal and the composite signal are below the predetermined level, wherein the bypass enables the canceller when the estimated maximum power level of the first signal minus the estimated return loss is greater than both a threshold of hearing and the estimated power level of the noise of the recovered second signal minus 8 dB;

a filter adapter for controlling convergence of an adaptive filter responsive to the estimated signal characteristics;

a first power estimator to estimate a maximum power level of the first signal;

a second power estimator to estimate a noise power level for the recovered second signal; and

adaptation logic to estimate a return loss between the first signal and the composite signal.

Claim 33. – 34. (Cancelled)

Claim 35. (Previously presented) The signal conditioner of claim 32, comprising a power estimator to estimate a maximum power level and an average power level of the first signal, and adaptation logic to estimate a return loss between the first signal and the composite signal, wherein the bypass enables the canceller as a function of at least one of the estimated maximum power level, the estimated average power level, and the estimated return loss.

Claim 36. (Cancelled)

Claim 37. (Previously presented) The signal conditioner of claim 35, comprising a second power estimator to estimate an average power level of the composite signal, wherein the adaptation logic estimates the return loss by dividing the estimated average power level of the first signal by the estimated average power level of the composite signal.

Claim 38. (Previously presented) The signal conditioner of claim 37, wherein the bypass enables the canceller when the estimated maximum power level of the first signal minus the estimated return loss is at least 8 dB greater than the estimated power level of the composite signal.

Claim 39. (Cancelled)

Claim 40. (Previously presented) The signal conditioner of claim 32, comprising a processor, and adaptation logic which invokes the processor to suppress the recovered second signal when information is detected in the first signal but not in the composite signal.

Claim 41. (Previously presented) The signal conditioner of claim 40, wherein the information includes voice.

Claim 42. (Cancelled)

Claim 43. (Previously presented) The signal conditioner of claim 32, comprising a filter adapter to adjust the adaptation of the adaptive filter.

Claim 44. (Previously presented) The signal conditioner of claim 43, comprising adaptation logic to estimate a return loss between the first signal and the composite signal, and a return loss enhancement between the composite signal and the recovered second signal, the filter adapter adjusting the adaptation of the adaptive filter as a function of the estimated return loss and the estimated return loss enhancement.

Claim 45. (Previously presented) The signal conditioner of claim 44, comprising a first power estimator to estimate a maximum power level and an average power level of the first signal, a second power estimator to estimate an average power level of the composite signal, a third power estimator to estimate an average power level and a noise power level for the recovered second signal, wherein the adaptation logic estimates the return loss and the return loss enhancement as a function of the estimated power levels.

Claim 46. (Previously presented) The signal conditioner of claim 45, wherein the adaptation logic estimates the return loss by dividing the average power level of the first signal by the average power level of the composite signal.

Claim 47. (Previously presented) The signal conditioner of claim 45, wherein the adaptation logic estimates the return loss enhancement by dividing the average power of the composite signal by the average power of the recovered second signal.

Claim 48. (Previously presented) The signal conditioner of claim 45, wherein the filter adapter causes the adaptive filter to have a filter adaptation step size of 1/4

when the estimated average power level of the first signal is 24 dB greater than the estimated power level of the noise of the recovered second signal.

Claim 49. (Previously presented) The signal conditioner of claim 45, wherein the filter adapter causes the adaptive filter to have a filter adaptation step size of 1/8 when the estimated average power level of the first signal is 18 dB greater than the estimated power level of the noise on the recovered second signal.

Claim 50. (Previously presented) The signal conditioner of claim 45, wherein the filter adapter causes the adaptive filter to have a filter adaptation step size of 1/16 when the estimated average power level of the first signal is 9 dB greater than the estimated power level of the noise on the recovered second signal.

Claim 51. (Previously presented) The signal conditioner of claim 44, wherein the filter adapter causes the adaptive filter to have an adaptation step size of 1/16 when a combination of the estimated return loss and the estimated return loss enhancement is in the range of about 23-33 dB.

Claim 52. (Previously presented) The signal conditioner of claim 44, wherein the adaptation logic limits the filter adapter when the adaptation logic detects information in the composite signal and the adaptive filter is converged.

Claim 53. (Previously presented) The signal conditioner of claim 52, wherein the information includes voice.

Claim 54. (Previously presented) The signal conditioner of claim 44, wherein the adaptation logic limits the adaptation of the adaptive filter when the adaptive filter has been active for a period longer than one second after an off hook transition of a telephony device coupled between the first signal and the composite signal.

Claim 55. (Previously presented) The signal conditioner of claim 44, wherein the adaptation logic limits the adaptation of the adaptive filter when the adaptive filter has been active for a period longer than one second after the adaptive filter is initialized.

Claim 56. (Previously presented) The signal conditioner of claim 44, wherein the filter adapter causes the adaptive filter to have an adaptation step size of 1/32 when the adaptation logic detects information in the composite signal and the adaptive filter is not converged.

Claim 57. (Previously presented) The signal conditioner of claim 44, wherein the filter adapter causes the adaptive filter to have an adaptation step size of one-fourth when the estimated return loss enhancement is in the range of 0-9 dBm.

Claim 58. (Previously presented) The signal conditioner of claim 44, wherein the filter adapter causes the adaptive filter to have an adaptation step size of 1/32 when a combination of the estimated return loss and the estimated return loss enhancement is greater than 33 dB.

Claims 59-63. (Cancelled)

Claim 64. (Previously presented) The method of claim 13, comprising selectively limiting filter adaptation, the selection of whether to limit the filter adaptation being based on the estimated characteristic.

Claim 65. (Cancelled)

Claim 66. (Previously presented) The method of claim 19, wherein the limiting of the filter adaptation comprises disabling the filter adaptation.

Claim 67. (Previously presented) The method of claim 26, wherein the near end is processed by attenuation.

Claim 68. (Previously presented) The method of claim 26, wherein the processing of the near end signal is non-linear.

Claim 69. (Previously presented) The signal conditioner of claim 40, wherein the processor comprises a non-linear processor.

Claim 70. (Previously presented) The signal conditioner of claim 43, wherein the filter adapter limits the adaptation of the adaptive filter when the bypass does not enable the canceller.

Claim 71. (Previously presented) The signal conditioner of claim 69, wherein the filter adaptation is limited by disabling the adaptation of the adaptive filter.

Claim 72-81. (Cancelled)

Claim 82. (Previously presented) Computer-readable media embodying a program of instructions executable by a computer to perform a method of cancelling a far end echo from a near end signal, the method comprising:

estimating an energy level of the far end echo;

cancelling the echo from the near end signal, if the estimated energy level of the far end echo is above an audible level;

bypassing the cancelling, if the estimated energy level of the far end echo is below the audible level; and

controlling convergence of an adaptive filter responsive to the estimated energy level of the far end echo,

wherein estimating the energy level of the far end echo comprises estimating a power level of the far end signal, estimating an echo return loss between the far end signal and the near end signal, and estimating a power level for noise on the near end signal without the echo, and wherein the echo is canceled from the near end signal when the power level of the far end signal minus the echo return loss is greater than both a threshold of hearing and the power level for the noise minus an amount in the range of 8-12 dB.

Claim 83. (Previously presented) The computer-readable media of claim 82, wherein estimating the energy level of the far end echo comprises estimating a power level of the far end signal, and estimating an echo return loss between the far end signal and the near end signal, and wherein the echo is cancelled from the near end signal if

the estimated power level of the far end signal minus the echo return loss is greater than a threshold.

Claim 84. (Previously presented) The computer-readable media of claim 82, wherein estimating the energy level of the far end echo comprises estimating a power level of the far end signal, estimating an echo return loss between the far end signal and the near end signal, and estimating a power level of the near end signal, wherein the selection of whether to cancel the echo from the near end signal is based on the estimated power levels and the estimated echo return loss.

Claim 85. (Previously presented) The computer-readable media of claim 82, wherein the echo cancellation comprises adaptively filtering the far end signal and subtracting the filtered far end signal from the near end signal.

Claim 86. (Previously presented) The computer-readable media of claim 85, wherein the method comprises selectively limiting filter adaptation, the selection of whether to limit the filter adaptation being based on the estimated characteristic.

Claim 87. (Previously presented) The computer-readable media of claim 86, wherein the filter adaptation is limited by disabling the filter adaptation.

Claim 88. (Cancelled)

Claim 89. (Previously presented) The computer-readable media of claim 85, wherein estimating the energy level of the far end echo comprises estimating an echo return loss between the far end signal and the near end signal, and estimating an echo return loss enhancement between the near end signal and the near and signal without the echo, and wherein filter adaptation is a function of at least one of the echo return loss and echo return loss enhancement.

Claim 90. (Previously presented) The computer-readable media of claim 89, wherein the filter adaptation comprises using an adaptation step size of one-fourth when the echo return loss enhancement is in the range of 0-9 dBm.

Claim 91. (Previously presented) The computer-readable media of claim 89, wherein the filter adaptation comprises using an adaptation step size of 1/32 when a combination of the estimated echo return loss and the echo return loss enhancement is greater than 33-36 dB.

Claim 92. (Previously presented) The computer-readable media of claim 89, wherein the filter adaptation comprises using an adaptation step size of 1/16 when a combination of the estimated echo return loss and the echo return loss enhancement is in the range of 23-33 dB.

Claim 93. (Previously presented) The computer-readable media of claim 85, wherein the method comprises detecting information in the near end signal, wherein the filter adaptation comprises limiting the filter adaptation when the information is detected and the filter adaptation is converged.

Claim 94. (Previously presented) The computer-readable media of claim 93, wherein the limiting of the filter adaptation comprises disabling the filter adaptation.

Claim 95. (Previously presented) The computer-readable media of claim 85, wherein the filter adaptation is limited when the filter adaptation has been active for a period longer than one second from an off hook transition of a telephony device connected between the far end signal and the near end signal.

Claim 96. (Previously presented) The computer-readable media of claim 85, wherein the filter adaptation is limited when the filter adaptation has been active for a period longer than one second after filter adaptation initialization.

Claim 97. (Previously presented) The computer-readable media of claim 93, wherein the filter adaptation comprises using an adaptation step size of 1/32 when the information is detected and the filter adaptation is not converged.

Claim 98. (Previously presented) The computer-readable media of claim 85, wherein estimating the energy level of the far end echo comprises estimating a power

level of the far end signal, and estimating a power level for noise on the near end signal without the echo, and wherein the filter adaptation comprises using an adaptation step size of 1/4 when the estimated power level of the far end signal exceeds the estimated power level of the noise by at least 24 dB.

Claim 99. (Previously presented) The computer-readable media of claim 85, wherein estimating the energy level of the far end echo comprises estimating a power level of the far end signal, and estimating a power level for noise on the near end signal without the echo, and wherein the filter adaptation comprises using an adaptation step size of 1/8 when the estimated power level of the far end signal exceeds the estimated power level of the noise by at least 18 dB.

Claim 100. (Previously presented) The computer-readable media of claim 85, wherein estimating the energy level of the far end echo comprises estimating a power level of the far end signal, and estimating a power level for noise on the near end signal without the echo, and wherein the filter adaptation comprises using an adaptation step size of 1/16 when the estimated power level of the far end signal exceeds the estimated power level of the noise by at least 9 dB.

Claim 101. (Previously presented) The computer-readable media of claim 82, wherein the method comprises detecting information in the far end signal, detecting information in the near end signal, and processing the near end signal when information is detected in the far end signal and not in the near end signal.

Claim 102. (Previously presented) The computer-readable media of claim 101, wherein the near end is processed by attenuation.

Claim 103. (Previously presented) The computer-readable media of claim 101, wherein the processing of the near end signal is non-linear.

Claim 104. (Previously presented) The computer-readable media of claim 82, wherein estimating the energy level of the far end echo comprises estimating a power level of the far end signal, estimating a power level of the near end signal, estimating a

power level of a near end signal without the echo, estimating a power level of noise on the far end signal, and selectively non linear processing the near end signal, the selection as to whether to non linear process the near end signal being based on the estimated power levels.

Claim 105. (Previously presented) The computer-readable media of claim 104, wherein the method comprises setting a first decision variable as a function of the estimated power level of the far end signal, setting a second decision variable as a function of the power level of the near end signal without the echo, setting a third decision variable as a function of the estimated power level of the far end signal and the near end signal without the echo, wherein the near end signal is non linear processed when at least one of the three decision variables meet a respective criteria.

Claim 106. (Previously presented) The computer-readable media of claim 105, wherein the first decision variable is set when the estimated power level of the far end signal is at least 6 dB greater than the estimated power level of the noise on the far end signal, and the estimated power level of the far end signal minus an estimated echo return loss between the far end signal and the near end signal is at least 6 dB greater than the estimated power level of the near end signal.

Claim 107. (Previously presented) The computer-readable media of claim 104, wherein the second decision variable is set when the estimated power level of the near end signal without the echo is at least 9 dB less than the estimated power level of the near end signal.

Claim 108. (Previously presented) The computer-readable media of claim 104, wherein the third decision variable is set when the estimated power level of the far end signal minus the estimated power level of the near end signal without the echo is greater than a threshold power level.

Claim 109. – 170. (Cancelled)

Claim 171. (Previously presented) A signal conditioner for conditioning a composite signal, the composite signal being formed by introducing at least a portion of a first signal into a second signal, comprising:

a first estimation means for estimating a signal characteristic of the first signal;

a second estimation means for estimating a signal characteristic of the composite signal;

canceller means for recovering the second signal from the composite signal, if the estimated signal characteristic of the first signal and of the composite signal are above a predetermined level, the canceller means comprising adaptive filter means for filtering the first signal, and means for subtracting the filtered first signal from the composite signal to recover the second signal;

bypass means for enabling the cancelling means, if the estimated signal characteristic of the first signal and the composite signal are below the predetermined level;

controlling means for controlling convergence of an adaptive filter responsive to the estimated signal characteristics;

adjusting means for adjusting the adaptation of the adaptive filter means;

return loss estimation means for estimating a return loss between the first signal and the composite signal and a return loss enhancement between the composite signal and the recovered second signal, and wherein the adjusting means adjusts the adaptation of the adaptive filter means as a function of the estimated return loss and the estimated return loss enhancement;

means for estimating a maximum power level and an average power level of the first signal, and means for estimating a return loss between the first signal and the composite signal, wherein the bypass means enables the canceller means as a function of at least one of the estimated maximum power level, the estimated average power level, and the estimated return loss; and

second means for estimating an average power level of the composite signal, wherein the means for estimating a return loss divides the estimated average

power level of the first signal by the estimated average power level of the composite signal,

wherein one or more of the following are true: the adjusting means causes the adaptive filter means to have an adaptation step size of one-fourth when the estimated return loss enhancement is in the range of 0-9 dBm, the adjusting means causes the adaptive filter means to have an adaptation step size of 1/16 when a combination of the estimated return loss and the estimated return loss enhancement is in the range of 23-33 dB, the adjusting means causes the adaptive filter means to have an adaptation step size of 1/32 when a combination of the estimated return loss and the estimated return loss enhancement is greater than 33 dB, and the adjusting means causes the adaptive filter means to have an adaptation step size of 1/32 when information is detected in the composite signal and the adaptive filter means is not converged, and

wherein the bypass means enables the canceller means when the estimated maximum power level of the first signal minus the estimated return loss is at least 8 dB greater than the estimated power level of the composite signal.

Claim 172. (Previously presented) A method of cancelling a far end echo from a near end signal, comprising:

estimating an energy level of the far end echo;

cancelling the echo from the near end signal, if the estimated energy level of the far end echo is above an audible level;

bypassing the cancelling, if the estimated energy level of the far end echo is below the audible level;

controlling convergence of an adaptive filter responsive to the estimated energy level of the far end echo;

wherein estimating the energy level of the far end echo comprises estimating a power level of the far end signal, estimating a power level of the near end signal, estimating a power level of a near end signal without the echo, estimating a power level of noise on the far end signal, and selectively non linear processing the

near end signal, the selection as to whether to non linear process the near end signal being based on the estimated power levels; and

setting a first decision variable as a function of the estimated power level of the far end signal, setting a second decision variable as a function of the power level of the near end signal without the echo, setting a third decision variable as a function of the estimated power level of the far end signal and the near end signal without the echo, wherein the near end signal is non linear processed when at least one of the three decision variables meet a respective criteria,

wherein the first decision variable is set when the estimated power level of the far end signal is at least 6 dB greater than the estimated power level of the noise on the far end signal, and the estimated power level of the far end signal minus an estimated echo return loss between the far end signal and the near end signal is at least 6 dB greater than the estimated power level of the near end signal.